VOLUMETRICS

CERTIFIED
HOT MIX ASPHALT
PRODUCER PROGRAM
AUDIT CHECKLIST

Date _____ Page ___ of ___

Plant No. _____

Producer _____

Plant Location _____

DMTE or _____

INDOT Audit Team Members

	Name	Position
1.	_____	Area Supervisor
2.	_____	Technician
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____

Producer Members

	Name	Position
1.	_____	Management Representative
2.	_____	Certified Asphalt Tech.
3.	_____	_____
4.	_____	_____

1. GENERAL INSTRUCTIONS

DMTE

401 QC/QA Hot Mix Asphalt (QC/QA HMA)
402 Hot Mix Asphalt (HMA)
Volumetric Quality Control Plan (VQCP)
Approved Supplier Certification (ASC)
Job Mix Formula (JMF)
Design Mix Formula (DMF)
Reclaimed Asphalt Pavement (RAP)

Any square bracket marked by an X on the Audit Checklist requires a Corrective Action Sheet to be prepared. The Corrective Action Sheet will be prepared when a deficiency is found, and a copy given to the Producer by the end of the audit. All other square brackets shall have a check, if the item is satisfactory, or NA if not applicable.

Begin the audit by having all INDOT audit members review the VQCP before arriving at the Producer's site. Likewise, checklists prepared during previous audits, especially the last one, will be reviewed. All members of the INDOT audit team and the Producer's members should compare each page to verify that their VQCP includes all current addenda.

A listing of applicable INDOT documents and Indiana Test Methods are maintained in the Certified HMA Producer Program Document List. The current revision date for each publication is provided in the list.

1.1 [ ] Area Supervisor or _____ has listing of documents.

1.2 [ ] VQCP's of INDOT and the Producer are the same

2. PRODUCER GENERAL INFORMATION

ITM 583 Reference 15.2(a)

Area Supervisor or _____

2.1 [ ] Plant location and address in VQCP is correct
2.2 [ ] Plant telephone numbers in VQCP are correct
2.3 [ ]* Fax Number in VQCP is correct

* Only If Applicable

3. PRODUCER PERSONNEL References 5.0 15.2(b)

Area Supervisor or _____

The Producer employees identified in VQCP occupy the following positions.

3.1 [ ] Management Representative
3.2 [ ] Certified Asphalt Technician
3.3 [ ] Technician's Certification has not expired.

4. DOCUMENTS Reference 2.0

Area Supervisor or _____

Determine whether the following current documents are maintained at the Producer's lab, either by hard copies or electronically.

4.1 [ ] INDOT Special Provision for Volumetric Hot Mix Asphalt Producer Program
4.2 [ ] INDOT Standard Specification (Includes Applicable Supplemental Specifications and pertinent contract Special Provisions)
4.3 [ ] Indiana Hot Mix Asphalt Quality Assurance Certified Technician Program Manual
4.4 [ ] The INDOT, AASHTO, and ASTM Tests Methods that are **referenced in VQCP.** The documents are in accordance with the HMA Document List

ITM 207	___	ITM 906	___	AASHTO T 166	___
ITM 571	___	ITM 908	___	AASHTO T 209	___
ITM 572	___	ITM 909	___	AASHTO T 248	___
ITM 580	___	ITM 910	___	AASHTO T 255	___
ITM 586	___	AASHTO T 2	___	AASHTO T 287	___
ITM 587	___	AASHTO T 11	___	AASHTO T 312	___
ITM 902	___	AASHTO T 27	___	AASHTO PP 19	___
ITM 903	___	AASHTO T 30	___	AASHTO TP 2	___
ITM 905	___	AASHTO T 40	___	ASTM D 5821	___

4.5 [ ] Mix design, DMF, and JMF, for each mixture
4.6 [ ]* Fines correction data for each DMF and RAP

* Only If Applicable

_____

_____

_____

Documents (continued)

Determine whether the following documents are on file at the Producer's Plant.

4.7 [ ] The VQCP for the Plant
4.8 [ ] Weigh tickets indicating material from an ASC Producer
4.9 [ ] Instructions from Manufacturer concerning storage and handling of the PG binders
4.10 [ ] Plant calibrations for each DMF or JMF (Calibrations on Plant computer are acceptable)
4.11 [ ] Temperature recordation charts of the aggregate or mixture
4.12 [ ] Calibrations for Plant scales and verification of meters

5. CONTROL CHARTS Reference 13.0

Area Supervisor or _____

All control charts.

5.1 [ ] The control charts are maintained at the lab or Plant as indicated in the VQCP
5.2 [ ] All materials requiring a control chart have a chart for each parameter

___ Aggregate Stockpiles
___ Blended Aggregates
___ Binder Content of Mix
___ Air Voids
___ VMA

Select one mixture and check all of the control charts for conformance with the following criteria.

5.3 [ ] Mixture clearly titled and parameter indicated
5.4 [ ]* Maintained until 30 production points are plotted and the previous 30 points are displayed
5.5 [ ] Control chart legend in accordance with procedure identified in VQCP for each chart

* Only If Applicable

_____

_____

_____

Control Charts (continued)

Binder Content of Mixture

Target Mean

5.6 [ ] Value from DMF or JMF (Actual binder content is used for Ignition oven only)

Control Limits -- Single Test

5.7 [ ] Upper and lower shown
5.8 [ ] ± 0.7 from Target Mean

Air Voids

Target Mean

5.9 [ ] Value identified by Producer is _____

Control Limits -- Single Test

5.10 [ ] Upper and lower shown
5.11 [ ] ± 1.0 from Target Mean

Voids in Mineral Aggregates

Target Mean

5.12 [ ] Value from DMF or JMF

Control Limits -- Single Test

5.13 [ ] Upper and lower shown
5.14 [ ] ± 1.0 from Target Mean

Control Charts (continued)

Aggregate Stockpiles -- Aggregate Size _____

Target Mean

5.15 [ ] Critical sieve identified is _____
5.16 [ ] Value identified by Producer is _____

Control Limits -- Single Test

5.17 [ ] Control limits from Target Mean are as follows:

1 1/2 in.	-- ± 15.0	No. 16	-- ± 8.0
1 in.	-- ± 10.0	No. 30	-- ± 6.0
3/4 in.	-- ± 10.0	No. 50	-- ± 6.0
1/2 in.	-- ± 10.0	No. 100	-- ± 6.0
No. 4	-- ± 10.0	No. 200	-- ± 2.0
No. 8	-- ± 10.0		

Blended Aggregate -- Mixture _____

Target Mean

5.18 [ ] At least four critical sieves identified for base or intermediate mixture and at least three critical sieves identified for surface mixture
5.19 [ ] Values identified by Producer are:

_____ _____ _____ _____

Control Limits -- Single Test

5.20 [ ] Control limits from Target Mean are as follows:

	Base and Intermediate Mixtures					
Sieve	37.5 mm	25.0 mm	19.0 mm	12.5 mm	9.5 mm	Surface Mixture
1 1/2 in.	± 15.0	---	---	---	---	---
1 in.	± 10.0	± 10.0	---	---	---	---
3/4 in.	± 10.0	± 10.0	± 10.0	---	---	± 10.0
1/2 in.	± 10.0	± 10.0	± 10.0	± 10.0	---	± 10.0
No. 4	± 10.0	± 10.0	± 10.0	± 10.0	---	± 10.0
No. 8	± 10.0	± 10.0	± 10.0	± 10.0	± 10.0	± 8.0
No. 16	± 8.0	± 8.0	± 8.0	± 8.0	± 8.0	± 8.0
No. 30	± 6.0	± 6.0	± 6.0	± 6.0	± 6.0	± 4.0
No. 50	± 6.0	± 6.0	± 6.0	± 6.0	± 6.0	± 4.0
No. 100	± 6.0	± 6.0	± 6.0	± 6.0	± 6.0	± 3.0
No. 200	± 2.0	± 2.0	± 2.0	± 2.0	± 2.0	± 2.0

6. DIARY Reference 8.0

Area Supervisor or _____

Select at random one active production month for review of the diary. The diary shall be in accordance with the following requirements and information, except where "only if applicable" is noted. Contact the Project Engineer/Supervisor, if necessary, to determine the days of production.

6.1 [ ] Open format book
6.2 [ ] One or more pages for each day of production
6.3 [ ] Mixture produced and quantity
6.4 [ ] DMF or JMF number
6.5 [ ] Contract or purchase order number the mixture was sent to
6.6 [ ] Time samples obtained and tests completed (Samples are required to be tested within 48 h of the time the sample was taken. If all samples are tested the same day, a statement indicating that this occurred is acceptable)
6.7 [ ]* Significant events or problems
6.8 [ ] Signature of Certified Technician
6.9 [ ]* Other persons signature counter-signed by Certified Technician

Any nonconforming test shall be followed immediately by corrective action. A nonconforming test occurs for Aggregate Stockpiles, Blended Aggregate, Mixture Binder Content, RAP Binder Content, Air Voids or VMA when the single test control limits are exceeded. For moisture content a nonconforming test occurs when the moisture content of the mixture sampled at the Plant exceeds 0.3%. Search control charts and test data for nonconforming tests. If some are found, review the diary on the date of each test for notations regarding action taken.

6.10 [ ] Nonconforming test(s) are noted in diary
6.11 [ ] Corrective action was taken

* Only If Applicable

Plant # ___ ___ ___ ___ Page ___ of ___

7. SAMPLING AND TESTING Reference 9.1

Area Supervisor or _____

*Obtain the diary for one **QC/QA HMA** mixture produced during an active one month period. Perform calculations as needed and compare the quantities produced from the diary against the number of tests, thereby determining the frequency of testing. The previous or subsequent month in the diary may need to be obtained to verify the frequency of tests*

VCQP Frequencies

Aggregate Stockpiles _____

Blended Aggregate_____

Recycled Materials

Binder Content _____ Moisture _____

Gradation _____ CAA _____

Mixture (Plant)

Binder Content _____ Temperature _____

Moisture _____

Mixture (Pavement)

Air Voids _____ Binder Content _____

VMA _____ Moisture _____ (Surface Mixture)

7.1 [ ] Sampling and testing of Blended Aggregate for gradation is in accordance with VQCP

7.2 [ ] Sampling and testing of Aggregate Stockpiles for gradation is in accordance with VQCP

7.3 [ ] Sampling and testing of Mixture at the Plant for binder content, temperature, and moisture content is in accordance with VQCP

7.4 [ ] Sampling and testing of Mixture from the pavement for air voids, VMA, binder content and moisture (surface HMA only) is in accordance with VQCP

7.5 [ ]* Sampling and testing of Recycled Materials for binder content, gradation, coarse aggregate angularity, and moisture content is in accordance with VQCP

* Only If Applicable

SAMPLING AND TESTING (continued) Reference 9.2

Obtained the diary for one **HMA** mixture produced during an active one month period. Perform calculations as needed and compare the quantities produced from the diary against the number of tests, thereby determining the frequency of testing. The previous or subsequent month in the diary may need to be obtained to verify the frequency of tests. The frequency of sampling and testing shall be in accordance with the VQCP, but not less than:

1. The first 250 t and each subsequent 1000 t of each DMF or JMF for base and intermediate mixtures.

2. The first 250 t and each subsequent 600 t of each DMF or JMF for surface mixtures.

7.6 [ ] Sampling and Testing of Mixture for binder content, coarse aggregate angularity, gradation, and air voids is in accordance with VQCP.

Select randomly one test report for any one **QC/QA HMA** mixture and check the calculations performed for the Blended Aggregate, RAP, and Mixture. If only **HMA** mixture is produced, check the calculations for the **HMA** only.

Blended Aggregate

7.6 [ ]* Gradation of aggregate from mixture sample is calculated correctly.
7.7 [ ]* Gradation of aggregate from cold feed belt or belt discharge is calculated correctly (Drum Plants)
7.8 [ ]* Gradation of aggregate from each hot bin is calculated correctly and blend calculations are correct (Batch Plants)
7.9 [ ]* Moisture content of aggregate is calculated correctly

* Only If Applicable

SAMPLING AND TESTING (continued) Reference 9.2

* Recycled Materials

7.10 [ ] Moisture content calculated correctly
7.11 [ ] Binder content calculated correctly
7.12 [ ] Gradation of aggregate calculated correctly
7.13 [ ]* Coarse Aggregate Angularity for RAP calculated correctly

Hot Mix Asphalt -- Location of Sample _____

7.13 [ ]* Gradation from Mixture sample calculated correctly
7.14 [ ]* Moisture content calculated correctly
7.15 [ ] Binder content calculated correctly (fines correction, if required, is used in calculation)
7.16 [ ]* If Ignition Oven is utilized, correct calibration factors are used.
7.17 [ ] Bulk Specific Gravity calculated correctly
7.18 [ ] Maximum Specific Gravity calculated correctly
7.19 [ ] Determination of Air Voids and VMA calculated correctly

* Only If Applicable

CALCULATIONS

AGGREGATE GRADATION (AASHTO T 27)

$$\% \text{ Passing} = \frac{\text{Wt. Passing Each Sieve}}{\text{Original Dry Sample Wt.}} \times 100$$

AGGREGATE MOISTURE CONTENT (AASHTO T 255)

$$\% \text{ Moisture} = \frac{\text{Wt. of Original Sample - Wt. of Dried Sample}}{\text{Wt. of Dried Sample}} \times 100$$

HMA or RAP MOISTURE CONTENT (ITM 572)

$$\% \text{ Moisture} = \frac{\text{Wt. of Original Sample - Wt. of Dried Sample}}{\text{Wt. of Dried Sample}} \times 100$$

BINDER CONTENT (ITM 571)

$$\% \text{ Binder} = \frac{\text{Wt. of Sample} - (\text{Wt. of Extracted Aggregate} + \text{Wt. of Fines})}{\text{Wt. of Sample}} \times 100$$

HMA or RAP EXTRACTED AGGREGATE GRADATION (AASHTO T 30)

$$\% \text{ Passing} = \frac{\text{Wt. Passing Each Sieve}}{\text{Original Dry Wt. of Aggregate + Wt. of Fines*}} \times 100$$

*Not required for ignition oven

COARSE AGGREGATE ANGULARITY (ASTM D 5821)

$$\% \text{ CAA} = \frac{\text{Wt. of Crushed Particles}}{\text{Wt. of Crushed Particles + Wt. of Uncrushed Particles}} \times 100$$

CALCULATIONS (continued)

BULK SPECIFIC GRAVITY -- G_{mb} (AASHTO T 166)

$$G_{mb} = \frac{\text{Wt. of Specimen in Air}}{(\text{Wt. of Surface} - \text{Dry Specimen in Air}) - (\text{Wt. of Specimen in Water})}$$

MAXIMUM SPECIFIC GRAVITY -- G_{mm} (AASHTO T 209)

A = weight of oven dry sample in air
A_1 = weight of surface dry sample
B = weight of container in water, g
C = weight of container and sample in water, g
D = weight of container filled with water at 77°F
E = weight of container filled with sample and water at 77°F

Weighing in Air

$$G_{mm} = \frac{A}{A + D - E}$$

Weighing in Water

$$G_{mm} = \frac{A}{A - (C - B)}$$

Supplemental Procedure

$$G_{mm} = \frac{A}{A_1 + D - E}$$

AIR VOIDS (AASHTO PP 28)

$$\%\ \text{Air Voids} = \frac{G_{mm} - G_{mb}}{G_{mm}} \text{x}\, 100$$

VOIDS in the MINERAL AGGREGATE (AASHTO PP 28)

G_{sb} = Bulk Specific Gravity of Aggregate (obtained from DMF)
P_s = Aggregate, percent by total mass of HMA

$$\%\ \text{VMA} = 100 - \frac{G_{mb} P_s}{G_{sb}}$$

8. MIXING PLANT References 15.2 (d,e,h,j,m)

Asphalt Technician or _____

Inspect the site and observe the operation of the Plant to verify that the production process is in accordance with the VQCP and the Plant site layout diagram is correct.

Plant Site Layout

8.1 [ ]* All stockpiles have signs as indicated in VQCP
8.2 [ ]* Stockpile map is current and located as indicated in VQCP
8.3 [ ] Binder tanks are located correctly
8.4 [ ]* Fuel tank is located correctly
8.5 [ ]* Additive or modifier tank is located correctly
8.6 [ ]* Anti-adhesive supply is located correctly
8.7 [ ]* Field laboratory is located correctly
8.8 [ ] Visitor parking area is located correctly
8.9 [ ] Mixing Plant major components are located correctly

Material Stockpiles

8.10 [ ] Stockpiling procedure is in accordance with VQCP
8.11 [ ] Stockpiles are adequately spaced and not contaminated
8.12 [ ] Cold bin loading procedure is in accordance with VQCP

Anti-Adhesive Agent

8.13 [ ]* Anti-adhesive agent is product on Approved List
8.14 [ ]* Procedure for application of anti-adhesive agent is in accordance with VQCP.

Truck Loading

8.15 [ ] Procedure for loading trucks is in accordance with VQCP

Other Process Control Techniques

8.16 [ ]* Procedures are in accordance with VQCP

* Only If Applicable

9. LABORATORY References 6.0, 7.0

Asphalt Technician or _____

The laboratory will be inspected for compliance with the VQCP. If more than one laboratory is used for quality control, each laboratory will be inspected.

9.1 [ ] Facility acceptable for testing materials
9.2 [ ] All equipment listed in VQCP at laboratory
9.3 [ ] All equipment apparently in good working order
9.4 [ ]* Procedure for transportation of mixture to laboratory not located at plant is in accordance with VQCP

Check the calibration or verification records to verify that the frequency meets the minimum requirements and the documentation includes the following:

1.* Description of equipment including Model or Serial Number
2. Name of person performing calibration or verification
3.* Identification of calibration equipment
4. Date of calibration or verification and next due date
5. Reference of procedure used
6. Calibration or verification results

9.5 [ ] Balance(s) -- 12 mo.
9.6 [ ] Gyratory Compactor -- 1 mo.
9.7 [ ]* Ignition Oven -- each mix
9.8 [ ] Mechanical Shaker(s) -- 12 mo.
9.9 [ ]* Nuclear Asphalt Content Gauge -- each mix
9.10 [ ] Oven(s) -- 6 mo.
9.11 [ ] Sieves -- 6 mo.
9.12 [ ] Thermometer(s) -- 6 mo.
9.13 [ ] Vacuum Pump(s) -- 12 mo.
9.14 [ ] Volumetric Flask(s) -- 1 mo.(not required if weighing-in-water procedure used)

- Only If Applicable

INCLUDE THIS SHEET ONLY IF LABORATORY OTHER THAN AT THE CERTIFIED PLANT IS USED

LABORATORY (continued) References 6.0, 7.0

Asphalt Technician or _____

9.15 [ ] Facility acceptable for testing materials
9.16 [ ] All equipment listed in VQCP at laboratory
9.17 [ ] All equipment apparently in good working order
9.18 [ ]* Procedure for transportation of mixture to laboratory not located at plant is in accordance with VQCP

Check the calibration or verification records to verify that the frequency meets the minimum requirements and the documentation includes the following:

1.* Description of equipment including Model or Serial Number
2. Name of person performing calibration or verification
3.* Identification of calibration equipment
4. Date of calibration or verification and next due date
5. Reference of procedure used
6. Calibration or verification results

9.19 [ ] Balance(s) -- 12 mo.
9.20 [ ] Gyratory Compactor -- 1 mo.
9.21 [ ]* Ignition Oven -- each mix
9.22 [ ] Mechanical Shaker(s) -- 12 mo.
9.23 [ ]* Nuclear Asphalt Content Gauge -- each mix
9.24 [ ] Oven(s) -- 6 mo.
9.25 [ ] Sieves -- 6 mo.
9.26 [ ] Thermometer(s) -- 6 mo.
9.27 [ ] Vacuum Pump(s) -- 12 mo.
9.28 [ ] Volumetric Flask(s) -- 1 mo.(not required if weighing-in-water procedure used)

* Only If Applicable

10. MATERIAL SAMPLES

Asphalt Technician or _____

The Producer's Certified Technician shall obtain a sample of the RAP, if applicable, the blended aggregate, and mixture. The samples obtained shall be split by the Producer's Certified Technician and the Department's portion given to the INDOT audit team member. Samples shall be tested by both the Producer and INDOT.

The following test results will be determined. A copy of all test reports from both the INDOT audit team member and the Producer's Certified Technician will be attached to the audit checklist. The variation of test results will be shown in the remarks section of the INDOT audit team member's report for each material sampled and tested. The allowable variation will be as follows:

Sieves	Maximum % Difference
*1 in.	5
*3/4 in.	5
*1/2 in.	5
No. 8	3
No. 30	3
No. 200	3
Binder Content	
*RAP	0.5
Mixture	0.5

10.1 [ ] Gradation of blended aggregate is within limits
10.2 [ ]* Binder content of RAP is within limits
10.3 [ ] Binder content of Mixture is within limits

Testing procedures required by the VQCP shall be observed to verify that they comply with the Sampling, Sample Reduction, and Testing Procedures checklist. If the procedures have been verified by the Independent Assurance Technician within the same calendar year, this requirement may be omitted.

10.4 [ ] Sampling procedures are correct
10.5 [ ] Sample Reduction procedures are correct
10.6 [ ] Testing procedures are correct

* Only If Applicable

11. AUDIT CLOSE-OUT

DMTE or Area Supervisor

A meeting with the Producer will be conducted at the completion of the audit. The results of the audit will be discussed, and all outstanding matters will be completely resolved or solutions with deadlines will be established. When the INDOT test results of the split samples are complete and results analyzed, an Audit Close-Out meeting with the Producer will be necessary to discuss the results. Any addenda required by items listed on the Corrective Action Sheets shall be submitted at this time.

When all the results from the audit have been accumulated, including Audit Checklist pages, Sampling, Sample Reduction and Testing Checklist from the audit or the Independent Assurance Technicians verification report, INDOT test reports, Corrective Action Sheet(s), and other documentation as may be appropriate, the DMTE and/or Area Supervisor will review the documents to verify that they are prepared properly and complete.

Upon completion of the Audit Close-Out meeting, all documents will be sent to the Field Support Engineer, Materials and Tests Division.

_____

_____

_____

_____ _____

DMTE/Area Supervisor Signature Date

CORRECTIVE ACTION SHEET

SOURCE # ___ ___ ___ ___

DATE _____

ITEM _____

Problem Explanation: _____

_____

_____

_____

_____

_____

_____

Corrective Action To Be Taken Is: _____

_____

_____

_____

_____

_____

_____

Deadline Date Is: _____

Follow-up **Date** _____

Finding: _____

_____

_____

_____

If NOT corrected, prepare another Corrective Action Sheet.